What is claimed is:

1. An indirectly heated button cathode for an ion source, comprising a button member having a front face for emitting thermionic electrons, when in use, to form a plasma, said face for emitting having a central portion provided by a first material having a first thermionic work function and a peripheral portion, around said central portion, provided by a second material having a second thermionic work function greater than said first work function.

2. An indirectly heated button cathode as claimed in Claim 1, wherein said central portion is circular and said second portion is annular.

3. An indirectly heated button cathode as claimed in Claim 1, wherein said button member comprises a collar of said second material and a slug of said first material secured in said collar.

4. An indirectly heated button cathode as claimed in Claim 3, wherein said button member has a rear face opposite to said front face, for exposure to electron heating in use, and said slug protrudes rearwards relative to said collar.

5. An indirectly heated button cathode as claimed in 1, wherein at least part of said face for emitting is concave.

6. An indirectly heated button cathode as claimed in Claim 5, wherein said central portion of said face for emitting is concave.

7. An indirectly heated button cathode as claimed in Claim 1, wherein said second material is tungsten.

8. An indirectly heated button cathode as claimed in either Claim 1 or Claim 7, wherein said first material is tantalum.

9. An indirectly heated cathode for an ion source comprising a button member having a front face for emitting thermionic electrons, when in use, to form a plasma, at least part of said

face for emitting being concave.

10. An indirectly heated cathode for an ion source as claimed in Claim 9, wherein said front face is circular having a concentric central portion and an annular outer portion, wherein only said central portion is concave.

11. An indirectly heated cathode for an ion source comprising a button member having a front face for emitting thermionic electrons, when in use, to form a plasma, said button member having a rear face opposite to said front face for exposure to electron heating in use, said rear face having a central portion and an exposed surrounding portion, said central portion protruding rearwardly relative to said surrounding portion.

12. An indirectly heated cathode as claimed in Claim 11, wherein said button member comprises a collar piece and a slug piece secured in said collar piece said slug piece protruding rearwardly to form said central portion of said rear face.

13. An indirectly heated cathode as claimed in Claim 12, wherein said slug piece provides a central portion of said front face of the button member and said collar piece provides a peripheral portion of said front surface surrounding said central portion, said slug piece being secured in said collar piece so as to provide a temperature difference between said slug piece and said collar piece when said central portion of said rear face of the button member is exposed to electron heating.

14. A method of creating a plasma for use in ion implantation comprising

providing an arc chamber with an indirectly heated button cathode having a button member with a front face for emitting thermionic electrons into said arc chamber for acceleration therein to form a plasma,

forming a central portion of said face for emitting with a first material having a first thermionic work function,

forming a peripheral portion of said face, around said central portion, with a second material having a second

thermionic work function greater than said first work function,

accelerating electrons, thermionically emitted by a filament onto a rear face of said button member opposite to said front face, to heat said button member to cause thermionic emission of electrons from at least said central portion of said front face of the button member,

and electrically biasing said cathode to accelerate said thermionically emitted electrons from said front face of said button member to ionise gas molecules in said arc chamber to produce a plasma therein.

15. A method of creating a plasma for use in ion implantation comprising

providing an arc chamber with an indirectly heated button cathode having a button member with a front face for emitting thermionic electrons into said arc chamber for acceleration therein to form a plasma,

forming at least part of said face for emitting to be concave,

accelerating electrons, thermionically emitted by a filament onto a rear face of said button member opposite to said front face, to heat said button member to cause thermionic emission of electrons from at least said concave part of said front face of said button member,

and electrically biasing said cathode to accelerate said thermionically emitted electrons from said front face of said button member to ionise gas molecules in said arc chamber to produce a plasma therein.

16. A method of creating a plasma for use in ion implantation comprising

providing an arc chamber with an indirectly heated button cathode having a button member with a front face for emitting thermionic electrons into said arc chamber for acceleration therein to form a plasma,

forming a rear face of said button member, opposite to said front face, with a central portion of said rear face protruding rearwardly relative to an exposed surrounding portion of said rear face,

accelerating electrons, thermionically emitted by a

filament, onto said protruding central portion of said rear face of said button member, to heat said button member to cause thermionic emission of electrons from at least a central portion of said front face of the button member corresponding to said central portion of said rear face,

and electrically biasing said cathode to accelerate said thermionically emitted electrons from said front face of said button member to ionise gas molecules in said arc chamber to produce a plasma therein.

17. An ion source comprising an arc chamber having first and second opposed walls,

an indirectly heated button cathode located in said first wall, and

an electron reflector located in said second wall, said button cathode having a disc-shaped button member with a generally circular front face for emitting thermionic electrons, when in use, to form a plasma in said arc chamber, said front face for emitting having a central portion provided by a first material having a first thermionic work function and a peripheral portion, around said central portion, provided by a second material having a second thermionic work function greater than said first work function, said electron reflector having a disc-shaped head member providing a generally circular reflecting face formed of said first material directed towards said front face of said button member,

the ion source further comprising

a magnet to provide a magnetic field in said arc chamber aligned between said front face of said button member and said reflecting face of said head member to confine electrons to a column extending in said arc chamber between said cathode and said electron reflector.

18. An ion source as claimed in Claim 17, wherein said first material is tantalum and said second material is tungsten.